Ultratec PD1 SERIES

Pocket Doppler

SERVICE MANUAL

CONTENTS

1. General Introduction

1.1. Introduction

This service manual is written to support the maintenance and repair of the ***PD1*** Series Doppler detectors.

Servicing of this equipment should be performed by a qualified technician, after carefully studying this manual.

The drawings and circuit descriptions in this manual are correct as of the date it was prepared, however, however the Company reserves the right to make changes to improve the operation of the instrument. If your instrument does not exactly match the information in this manual, contact the manufacturer or distributor for revision information.

Inspect the instrument upon receipt, in the unlikely event that the unit has been damaged, notify your distributor or Ultrasound Technologies directly at the following address: -

Ultrasound Technologies Ltd.,

Foresters House,

Itton, Chepstow,

Gwent

Telephone: +44 (0) 1291 641301

FAX: +44 (0) 1291 641302

E-mail: service@ultrasound.demon.co.uk

Retain the packing material for possible future use.

Important Note:

In the unlikely event that the instrument must be returned to Ultrasound Technologies for service or for any other reason, use the same packing material in which the instrument was delivered.

If this is not available, the instrument should be packed in such a way that will provide adequate packing. The Company will not accept any responsibility for loss or damage due to improper use of packing material.

1.1 Re - Order Information

Listed below are the consumables used with the PD1 Series Pocket Dopplers: -

Description
Aquasonic Gel 60 gm.
MN1604 Alkaline Battery

1.2 Symbols

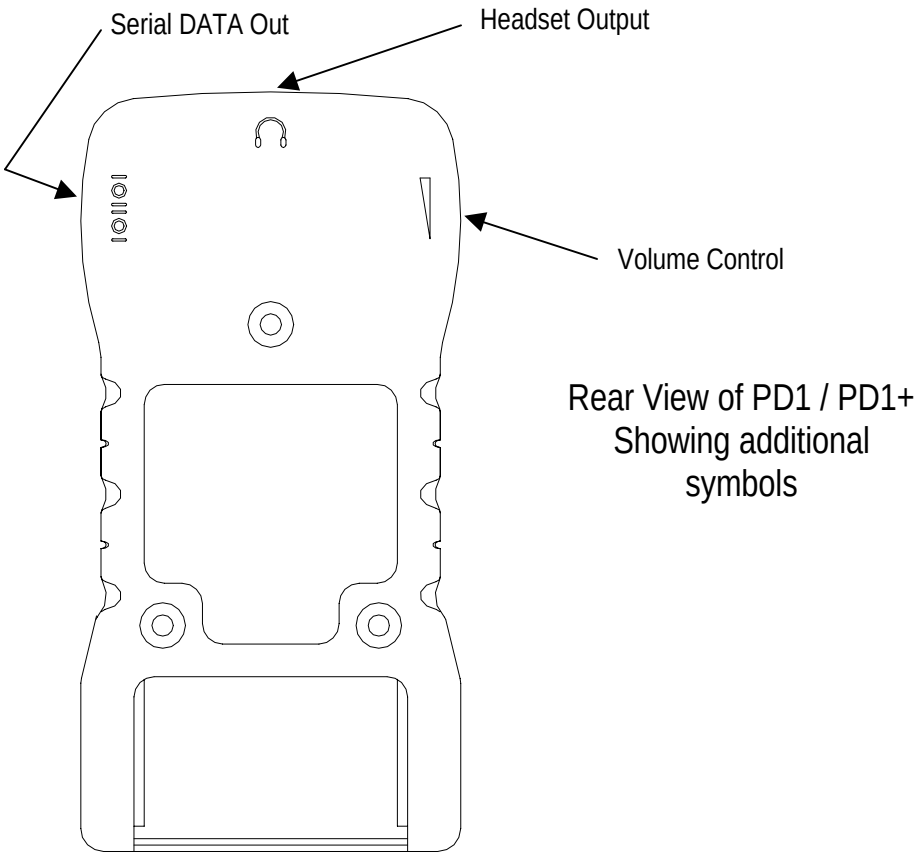
The following symbols have been used on the PD1 and are here defined according to IEC601 and B.S.5724.

IEC Symbol 878-02-02

Type B Equipment.

IEC Symbol 348

Attention Consult accompanying documents



Rear View of PD1 / PD1+
Showing additional
symbols

1.3 CE Mark

This product complies with the essential requirements of the European Council Directive 93/42/EEC relating to Medical Devices.

1.4 Guidelines for identifying and resolving adverse EMC conditions

This product is classified as a Class A Group 1 type of product according to EN55011. This product is allowed in domestic establishments under the jurisdiction of a Healthcare professional.

Emissions

Care has been taken through the design and manufacturing process to minimise the EM emissions, which may be produced by this equipment. However, in the unlikely event that the unit causes an EM disturbance to adjacent equipment, we suggest that the procedure is carried out 'out of range' of the affected equipment.

Immunity

If the user has any doubt regarding the units EM immunity during routine operation, we suggest that the source of EM disturbance is identified and it's emissions reduced.

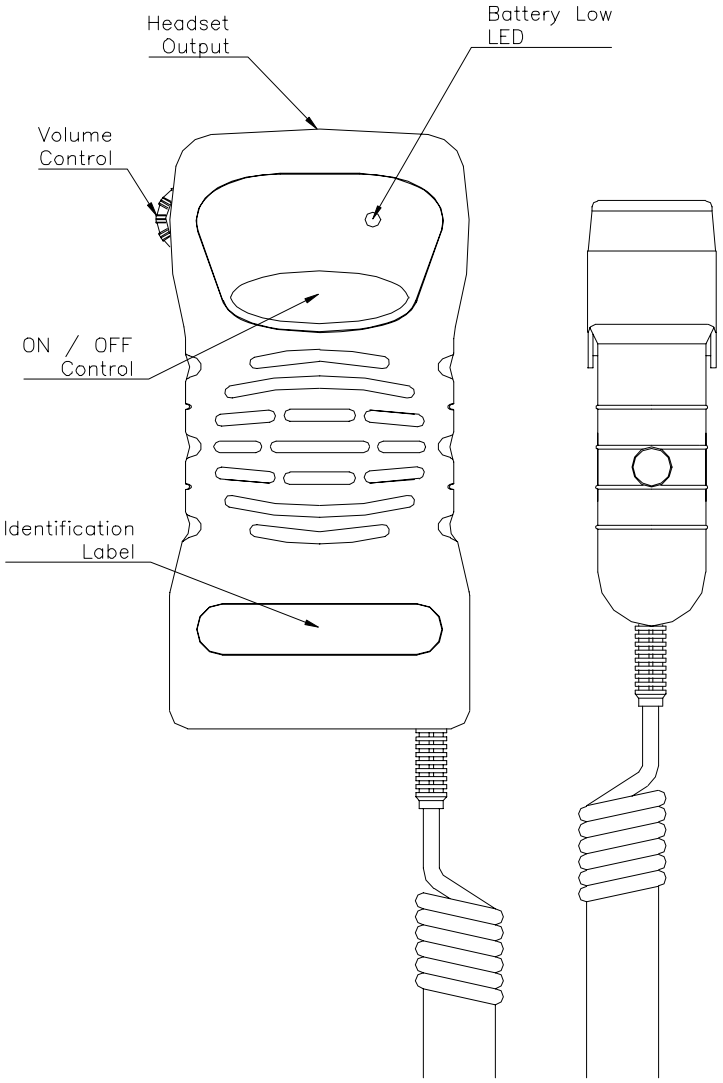
If the user has any doubt regarding the identification and resolution of adverse EM conditions, they should contact Ultrasound Technologies Ltd. directly who will advise on the situation. The address can be found in the front of this manual.

2. Description of the Instrument

2.1. Audio Unit *PD1*

The following functions are found on the ***PD1*** Pocket Doppler (refer to page 3 of your operating instructions): -

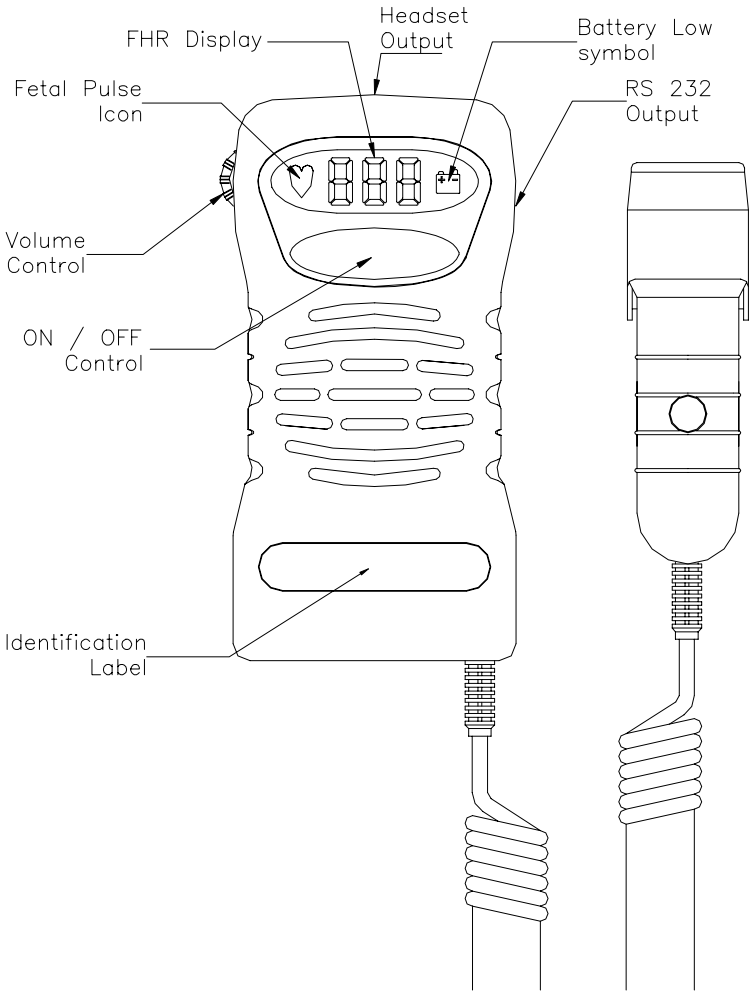
UNIT ON/OFF	On / Off control.
BATTERY LOW	LED indicator to show when the battery has reached a point when it requires changing.
VOLUME CONTROL	Rotary edge potentiometer, which increases or decreases the setting of the volume.
HEADSET	Audio output for connection to a stereo headset for private listening.



2.2. Audio Unit PD1+

The following functions are found on the ***PD1+*** Pocket Dopplers (refer to page 3 of your operating instructions):-

UNIT ON/OFF	On / Off control.
VOLUME CONTROL	Rotary edge potentiometer, which increases or decreases the setting of the volume.
HEADSET	Audio output for connection to a stereo headset for private listening.
RS 232 Interface	Serial data output, for connection to the optional *ULTRATRACE 2* PC software. Connections are made via the 3.5mm Stereo jack socket.
FHR DISPLAY	Custom LCD module displays FHR rate, FH pulse and Battery condition.

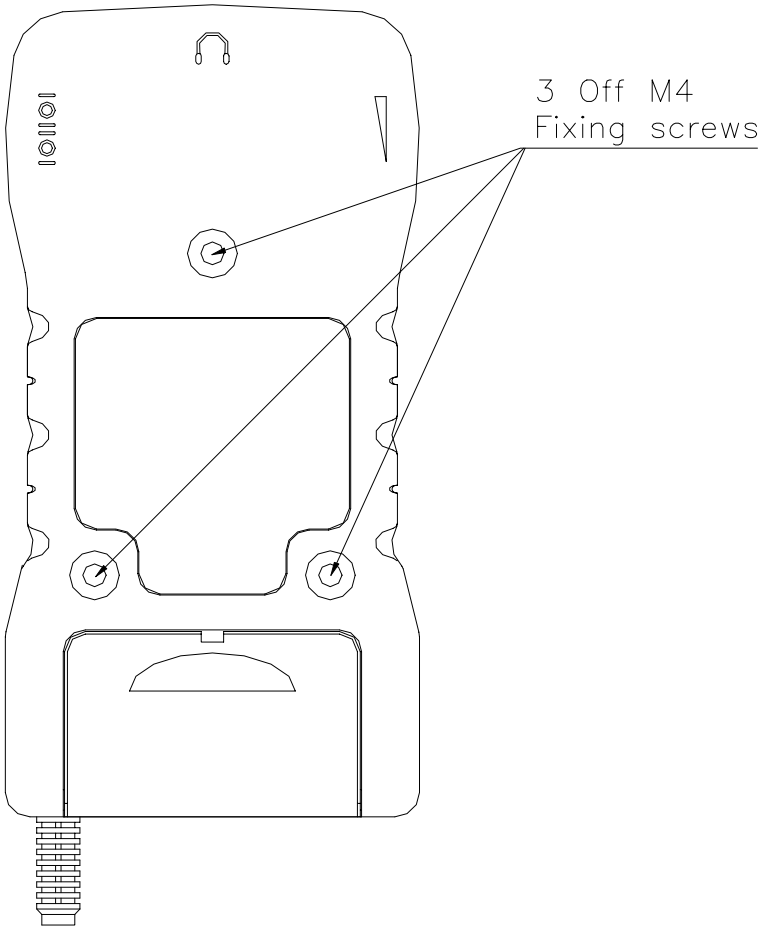


2.3. Dismantling Instructions

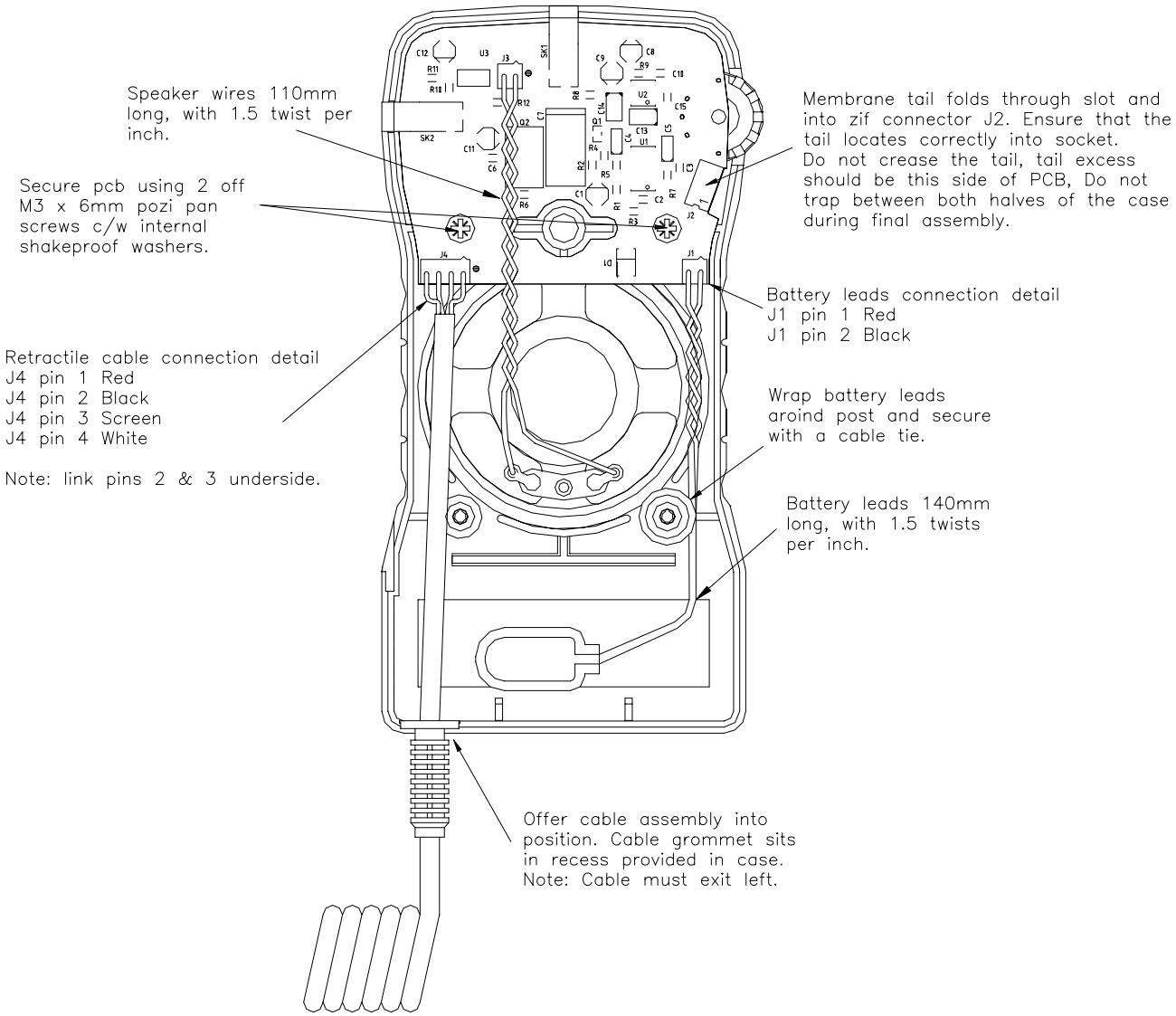
Special Note: -The instrument must not be dismantled when in use on a patient, ensure all accessories are disconnected.

2.4. Audio Unit

The Audio unit houses the main circuit board. To remove the circuit board, turn the unit onto it's front and remove the three M4 countersunk screws. The rear panel will now come away revealing the PCB.



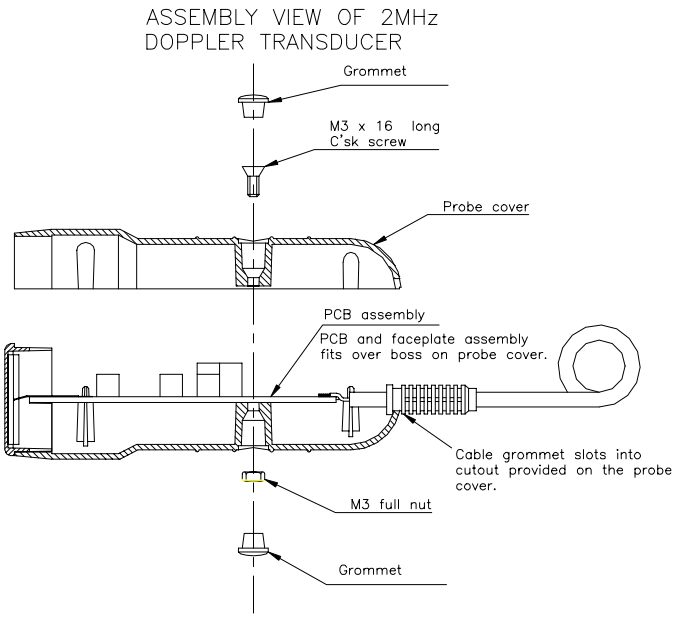
Remove the two M3 screws securing the PCB.



The transducers, loudspeaker and battery connections are ‘hard wired’ to the PCB. De-solder the connections at J4 (retractile cable) and J3 (loudspeaker), the PCB can then be pulled clear of the case.

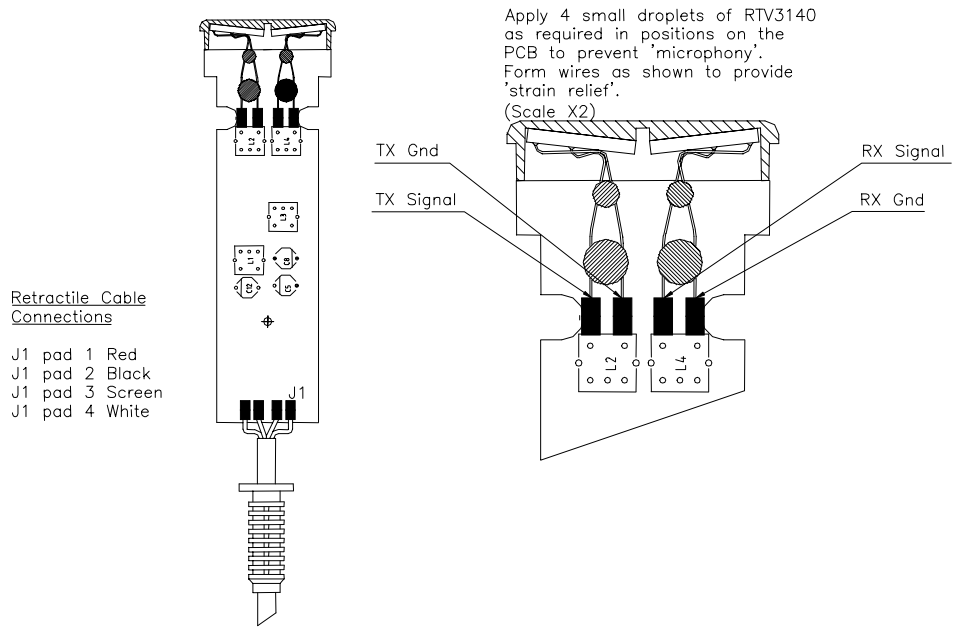
1.5 Transducers

The transducers are a ‘sealed unit’. However, it is possible to gain access to the 2 MHz assembly by removing the two blanking grommets and M3 countersink screws. Removing the screws will allow the assembly to be split along its length. Gently prise the assembly apart.



The circuit board is bonded and keyed to the faceplate assembly using a high strength cyno-acrylic adhesive.

Circuit board removal is carried out by carefully breaking the bond and de-soldering the crystal wires and retractile cable connections (see diagram below).



2.0 Circuit Description

2.1 Introduction

The circuit has been divided into functional blocks with each block being described separately, the blocks are as follows:

- Audio Unit Power Supply
- Battery Low Indicator
- Ultrasound Transducer
- Oscillator and Detector
- Oscillator and Transmitter Amplifier
- Receiver and Detector
- Audio Amplifier
- Controls and Indicators
- Unit ON / OFF
- Battery Low

2.2 Audio Unit Power Supply

The unit operates from a single 9-Volt dry battery. It is recommended that only alkaline cells be used. The audio circuit is fed directly from the battery. D1 provides circuit protection from battery reversal.

The unit is turned on by the membrane switch, which is mounted on the front of the unit. Closing the switch, grounds the CLK input of U1 pin 3, the output on pin 2 switches on Q2 allowing current to flow into the various circuits.

The unit will remain switched on for approximately 5 minutes (set by C4 and R5) after which it turns off automatically, unless the user forces the unit off by de-pressing the ON/OFF switch.

2.3 Battery Low Indicator

U3 is a voltage detector, when the voltage on pin 1 drops below the threshold set by R10 and R11 (7.3V), the output state changes forcing the LED (D2) to illuminate.

2.4 Ultrasound Transducer

The ultrasound transducer operates on the continuous wave Doppler principle. There are a number of transducer frequencies suitable for different applications, however the basic operating principles are identical.

Each transducer consists of a pair of piezo ceramic crystals, each crystal pair is arranged as a transmitter and receiver, the ultrasonic output beam is focussed through a lens or faceplate.

With the exception of the 2MHz Fetal transducer, the electronics are housed in the main audio unit.

The oscillator and detector are built up of four discrete sections. These are the master oscillator, transmitter amplifier, receiver amplifier and detector.

These operate to produce a continuous wave ultrasound signal that is passed to the transmitting crystal in the transducer.

The signal is then reflected from moving interfaces within the body to the receiver crystal in the transducer, amplified and then detected so the audio Doppler shift of that moving interface can be heard audibly and / or converted into a velocity signal.

2.5 Oscillator and Transmitter Amplifier

Field effect transistor Q2, with L1, C16, C17 and associated components form a Colpitts oscillator. This oscillator runs at a nominal frequency of 2, 5 or 8MHz producing a sinewave of amplitude of approximately 5V Pk.

The signal is then fed to output transistor Q3 that drives the transmitter crystal in the transducer. The output power is set by VR1. The signal is fed to the transducer via a tuned transformer L2 (C23), the output impedance of which is set correctly to match the transducer crystal impedance. The output drive signal is nominally 1.5V Pk.

2.6 Receiver and Detector

The reflected Doppler signal is fed via a resonant transformer L4 (C25) to the gate of Q5, the drain of this FET connects to the source of Q4 to form a cascode amplifier the drain of which contains the resonant circuit L3,(C21).

From the drain of Q4 the amplitude complex of the received signal is detected by passing the signal through diode D2 with the high frequency signals being filtered by R12 and C15.

The raw low frequency complex is then amplified and filtered by U1 where its associated components form a band pass filter amplifier with a bandwidth of 150Hz to 1KHz for the obstetrics or 300Hz to 4KHz in the vascular transducer.

This signal is passed to the audio unit via the retractile cable.

2.7 Audio Amplifier

The audio signal is routed via the retractile cable to J4 pin 4 on the audio circuit board. The signal passes through the potentiometer VR1 to the audio amplifier U2, where it is amplified and output to the loudspeaker connected to J3.

2.8 Velocity Processor (PD1V Model Only)

The audio signal is fed from the band pass amplifier (U5) through the threshold control VR3 to the V to F converter (U3).

The conversion factor is 0.5V/ KHz with fine adjustment provided by VR2.

The output of this circuit is then scaled by R4, 6 to a suitable voltage level for most ECG machines and recorders.

3.0 Test and Calibration

3.1 Introduction

The following sections detail tests to ensure that the unit is operating within specification. These tests may be performed in whole or part, however, if any repairs are carried out to the power supply circuits then it is recommended that the whole test / calibration procedure is undertaken.

3.2 Performance Checks

The following procedure is intended to provide a means of determining the functional status of the unit. It should be included as part of a preventative maintenance plan and should be performed on a regular basis at least once a year.

Ensure that a full capacity alkaline cell is fitted.

Switch the unit ON and increase the volume to maximum. The battery low indicator will flash ON momentarily and then extinguish.

Place the transducer with ultrasound gel on the palm of the hand over the radial artery, a clear pulse will be heard.

Check the unit for signs of damage, particularly the transducer cable near the point of entry to the unit and transducer body.

3.3 Equipment

Oscilloscope 2 channel 50 MHz bandwidth minimum resolution 5mV/cm

DC Power Supply 0 – 30VDC @1A

Digital Multimeter 4 Digit measuring 1mV, 1mA, 0.1ohm

Frequency Counter 0 - 10MHz resolution at 2MHz 1KHz.

Signal Generator 10Hz to 10MHz 1mV to 10V Sinewave

3.4 Audio Unit

Set the power supply to 9VDC output and connect to battery fling leads.

Switch ON the power supply.

Switch the board under test ON by shorting pins 1 and 2 of connector J1.
Check the battery low LED flashes momentarily.

Check the current being drawn by the board under test is less than 50ma.

Using the DVM, measure the DC voltage at the Drain of Q2 (junction of C8 & C11) this will be between 8.80 and 8.60 V DC.

Carefully decrease the power supply output, check and record the voltage reading at which point the Battery low LED illuminates permanently. This will be between 7.0 and 7.5 V DC

Using a pair of tweezers, Introduce noise into pin 4 of J4. Rotate the volume control through its complete range of travel and observe the audio output from the speaker increases and decreases accordingly.

3.5 Transducer

Transmitter

Set the DC Power Supply to 9Vdc, solder the +ve lead to pin 1 of J1 and the –ve lead to J1 pin 2 on the board under test.

Switch ON the power supply, check the current being drawn by the board under test is less than 50ma.

Using the DVM, measure the DC voltage at the junction of C8 and R7, this will be between 5.2 and 5.8V DC.

Using the oscilloscope connected to the pad TxSig, adjust L1 so that the signal is set to 2.000MHz.

Adjust L2 to set the output to 1.5V pk/pk.

Receiver

Connect the oscilloscope to the junction of D2 and R12, adjust both L4 and L3 to maximise the DC signal.

Move the oscilloscope to J1 pin 4, carefully stroke the transducer faceplate and observe a low frequency signal is displayed on the oscilloscope. The measured output will be a DC voltage of greater than 5.5V.

3.6 Velocity Processor

With the oscilloscope set to AC input, adjust the output signal from audio generator to a frequency of 1kHz and an amplitude of 15mV + 1mV pk-pk. Connect this signal to the junction of C22 and U5 pin 1.

Set frequency to 10KHz and attach oscilloscope to pin 7 IC3, adjust VR3 until the signal just changes state from 0V to 5V. The signal will be rough DC.

Using a multimeter, place the +ve probe to the junction of R18, R19 and C19, adjust VR4 until the until the DC level measures 5V.

4.0 Fault finding guidelines

This section is an aid to trouble shooting and should be used in conjunction with the relevant circuit diagrams found at the rear of this manual. In each case the re calibration must be carried out after any repair.

The following tables list some of the symptoms and the relevant circuit areas.

NOTE Do not, under any circumstances attempt to repair the instrument whilst it is connected to a patient.

Symptom	Suspect Circuit	Check
Unit does not switch ON	Remote switch on front panel	J1 pin 1 goes low when switch is depressed
	U1 ON/OFF Control	Output goes low when switch is depressed
	Battery	J1 pin 1 > 7V
Battery Low LED on permanently	Battery condition	J1 pin 1 > 7V Replace battery
	U3 Comparator	See test / calibration section
Excessive battery drain	U1 / Q2 ON/OFF Control	Q2 must switch when switch is depressed. Change battery
Ultrasound OK but no audio	Transducer position	Re position transducer
	Crackling operation of volume control VR1	Replace volume control
	Broken conductor in cable	Check audio signal on pin 3 of U2
	Headphone socket SK2	Audio signal on J3 pin 1 Replace loudspeaker
Unit unstable	Ultrasound transducer	Check output drive into crystal is 1.5V pk/pk. Check received signal in transducer J1 pin 4, signal should be a low frequency audio signal approx. 2Vpk/pk. Replace transducer.

5.0 Parts list

The following section contains parts lists for the following items: -

- PD1+ Audio PCB assembly
- PD1 Audio PCB assembly
- PD1 2MHz Probe assembly
- PD1 Final assembly
- PD1+ Final assembly

5.1 PD1+ Audio PCB Assembly

Device	Value	Device Type	Circuit Reference	Quantity
Capacitor	470uF Electrolytic Axial 10V	Panasonic SU ECEB1AU471	C10	1
Capacitor	100uF Min Electrolytic 16V 5mm	Nippon Chemi-con SRA / Samsung SSM	C2,9,11,12,13,18,19,21,27,28,29,30,32,33,34,35,37	17
Capacitor	10uF tant 20V case size A	AVX / Kemet case size A	C5,15,16	3
Capacitor	0u47F tant 25V case size A	AVX / Kemet case size A	C7	1
Capacitor 0805	100nF Mono Ceramic	0805 series Z5U dielectric	C1,6,8,14,17	5
Capacitor 0805	47nF Mono Ceramic	0805 series X7R dielectric	C26	1
Capacitor 0805	10nF Mono Ceramic	0805 series X7R dielectric	C4,36	2
Capacitor 0805	1nF Mono Ceramic	0805 series COG dielectric	C20,31	2
Capacitor 0805	22pF Mono Ceramic	0805 series COG dielectric	C23,24	2
Capacitor 1206	1uF Z5U Ceramic	1206 series Z5U dielectric	C3,22,25	3
IC Analogue	CD4013D	Philips/ Harris/National	U2	1
IC Analogue	ZM33064Z	Zetex	U4	1
IC Analogue	LM386M-1	National	U3	1
IC Analogue	LM324M	National	U7	1
IC PSU	ICL7660CBA	Maxim	U1	1
IC PSU	ZR78L05G	Zetex	U11	1
IC Digital	CD74HC4066D	Philips/ Harris/National	U9	1
IC Digital	MAX1243BESA	Maxim	U6	1
IC Digital	MAX202ECSA	Maxim	U10	1
IC Digital	TSC87251G1-A16CB	Temec	U8	1

IC Digital	ICM7211AMIM44	Harris	U5	1
Diode	10BQ040	IR	D1	1
Diode	BAS16		D2,5	2
Crystal	12MHz	86SMX	X1	1
Transistor	RFD8P05SM	Harris	Q1	1
Resistors 1% 0805	10R	Samsung/Phillips/ROHM	R5,6	2
Resistors 1% 0805	100R	Samsung/Phillips/ROHM	R3	1
Resistors 1% 0805	2K2	Samsung/Phillips/ROHM	R7	1
Resistors 1% 0805	4K7	Samsung/Phillips/ROHM	R8	1
Resistors 1% 0805	10K	Samsung/Phillips/ROHM	R9,13,15,16,18,19,20,21,22,23,24,25,26, 28,29	15
Resistors 1% 0805	22K	Samsung/Phillips/ROHM	R17	1
Resistors 1% 0805	47K	Samsung/Phillips/ROHM	R12	1
Resistors 1% 0805	68K	Samsung/Phillips/ROHM	R11,14	2
Resistors 1% 0805	100K	Samsung/Phillips/ROHM	R10,27,31	3
Resistors 1% 0805	330K	Samsung/Phillips/ROHM	R30	1
Resistors 1% 0805	1M	Samsung/Phillips/ROHM	R1,2,4	3
LCD module	PD1D107			1
Volume Control	10K Log	Tsubuya 161P-N2, A10K	VR1	1
Volume Control Knob		Tsubuya 1KF-4B Black Knob	VR1 knob	1
Connector	Jack socket	Hosiden HSJ 1501-010010	P1,2	2
Connector	PP3 battery connector			1
Connector	Molex 3 way ZIF	Molex 39-51-4032	J2	1
PCB	PD1 plus audio board	PD1D109		1

5.2 PD1 Audio PCB Assembly

Device	Value	Device Type	Circuit Reference	Quantity
Capacitor	470uF Electrolytic Axial 10V	Panasonic SU ECEB1AU471	C7	1
Capacitor	100uF Min Electrolytic 16V 5mm	Nippon Chemi-con SRA / Samsung SSM	C1,8,9,11,12	5
Capacitor	10uF tant 20V	AVX / Kemet case size A	C13,14	2
Capacitor	0u47F tant 25V	AVX / Kemet case size A	C4,5	2
Capacitor 1206	100nF Mono Ceramic	1206 series Z5U dielectric	C6,8,9,10,15	5
Capacitor 1206	10nF Mono Ceramic	1206 series X7R dielectric	C3	1
Capacitor 1206	1uF Z5U Ceramic	1206 series Z5U dielectric	C2	1
IC Analogue	CD4013D	Philips/ Harris/National	U1	1
IC Analogue	ZM33064Z	Zetex	U3	1
IC Analogue	LM386M-1	National	U2	1
Diodes	10BQ040	IR	D1	1
Diode	LED Yellow	Temic TLLY4401	D2	1
Transistor	RFD8P05SM	Harris	Q2	1
Transistor	BSS138	Fairchild Semiconductor	Q1	1
Resistors 1% 1206	10R	Samsung/Phillips/ROHM	R8,9	2
Resistors 1% 1206	1K	Samsung/Phillips/ROHM	R2	1
Resistors 1% 1206	2K2	Samsung/Phillips/ROHM	R10	1
Resistors 1% 1206	4K7	Samsung/Phillips/ROHM	R11,12	2
Resistors 1% 1206	100K	Samsung/Phillips/ROHM	R4	1
Resistors 1% 1206	1M	Samsung/Phillips/ROHM	R3,5,6,7	4
Resistors 1% 1206	3M3	Samsung/Phillips/ROHM	R1	1
Volume Control	10K Log	Tsubaya 161P-N2, A10K	VR1	1
Volume Control Knob		Tsubuya 1KF-4B Black Knob	VR1 knob	1
Connector	Jack socket	Hosiden HSJ 1501-010010	P1,2	2
Connector	PP3 battery connector			1
Connector	Molex 3 way ZIF	Molex 39-51-3032	J2	1
PCB	PD1D103	PD1 Audio PCB		1

5.3 PD1 2MHz Transducer Assembly

Description	Value	Device Type	Circuit Reference	Quantity
Capacitor	100uF Min Electrolytic 16V 5mm	Nippon Chemi-con SRA / Samsung SSM	C5,8,12	3
Capacitor	1u0F tant 35V	case size A	C4,11	2
Capacitor	100nF Mono Ceramic	0805 series Z5U dielectric	C1,2,3,7,10,26,22,24	8
Capacitor	10nF Mono Ceramic	0805 series X7R dielectric	C18	1
Capacitor	22nF Mono Ceramic	0805 series X7R dielectric	C6,13	2
Capacitor	1n0F COG Ceramic	0805 series COG dielectric	C9,15,23	3
Capacitor	220pF COG Ceramic	0805 series COG dielectric	C19,20,25	3
Capacitor	330pF COG Ceramic	0805 series COG dielectric	C17	1
Capacitor	470pF COG Ceramic	0805 series COG dielectric	C21	1
Capacitor	680pF COG Ceramic	0805 series COG dielectric	C16	1
IC Analogue	TL072CD	SGS / TI	U1	1
Diodes	BZX84C6V2		D1	1
Diodes	BAT54		D2	1
Transistor	MMBF4416LT1	Motorola	Q2,4,5	3
Transistor	BC848B		Q1,3	2
Inductor	Toco 0838		L4	1
Inductor	Toco 0842		L3	1
Inductor	Toco 0841		L1	1
Inductor	Toco 0876		L2	1
Resistors 1% 0805	10R	Samsung/Phillips/ROHM	R17,16	2
Resistors 1% 0805	22R	Samsung/Phillips/ROHM	R7	1
Resistors 1% 0805	100R	Samsung/Phillips/ROHM	VR1	1
Resistors 1% 0805	1K	Samsung/Phillips/ROHM	R3,8	2
Resistors 1% 0805	1K5	Samsung/Phillips/ROHM	R15	1
Resistors 1% 0805	2K2	Samsung/Phillips/ROHM	R1,2,11	3
Resistors 1% 0805	27K	Samsung/Phillips/ROHM	R14	1
Resistors 1% 0805	100K	Samsung/Phillips/ROHM	R4,5,6,9,10,12,18,19	8
PCB	PD1D110	PD1 probe board		1
Piezo Ceramic Crystal	2MHz Resonant Frequency			2

Faceplate	PD1D102			1
Probe Cover	PD1D101			2
M3 x16 Pozi C'sk screw				1
M3 Full nut				1
Cover plug				2

5.4 PD1 Audio Unit General Assembly

Description	Part Number	Quantity
Case Front	PD1D105	1
Case Rear	PD1D106	1
Battery Slide	PD1D104	1
Loudspeaker		1
Retractile cable	PD1D100	1
Label front	PD1D108	1
Label rear	PD1D108	1
Front Membrane	PD1D108	1
M3 x 6 Pozi Pan screw		2
M3 Internal shakeproof washer		2
M4 x 12 Pozi Pan screw		3
Fibre flat washer		2
Cable tie		1
PVC Foam based adhesive strip		0.1
Serial number label		1

5.5 PD1+ General Assembly

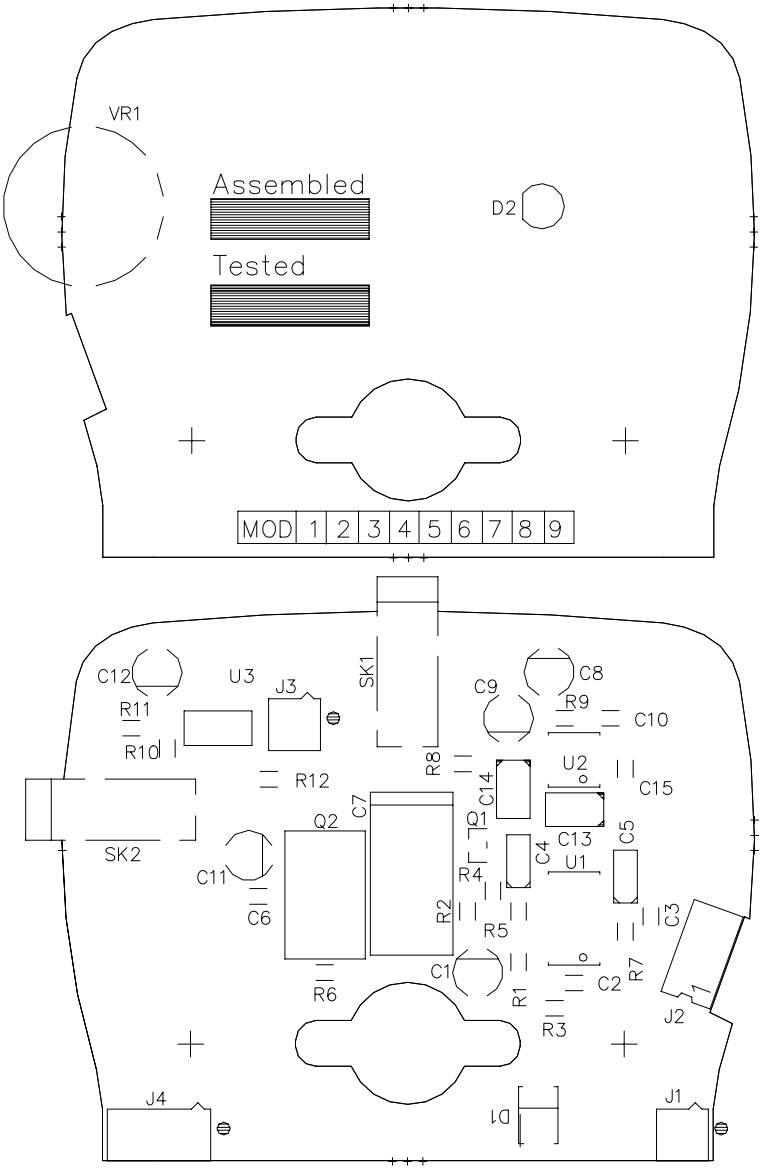
Description	Part Number	Quantity
Case Front	PD1D105	1
Case Rear	PD1D106	1
Battery Slide	PD1D104	1
Loudspeaker		1
Retractile cable	PD1D100	1
Label front PD1+	PD1D108	1
Label rear	PD1D108	1
Front Membrane PD1+	PD1D108	1
M3 x 6 Pozi Pan screw		2
M3 Internal shakeproof washer		2
M4 x 12 Pozi Pan screw		3
Fibre flat washer		2
Cable tie		1
PVC Foam based adhesive strip		0.1
Serial number label		1

6.0 Circuit Diagrams & Engineering Drawings

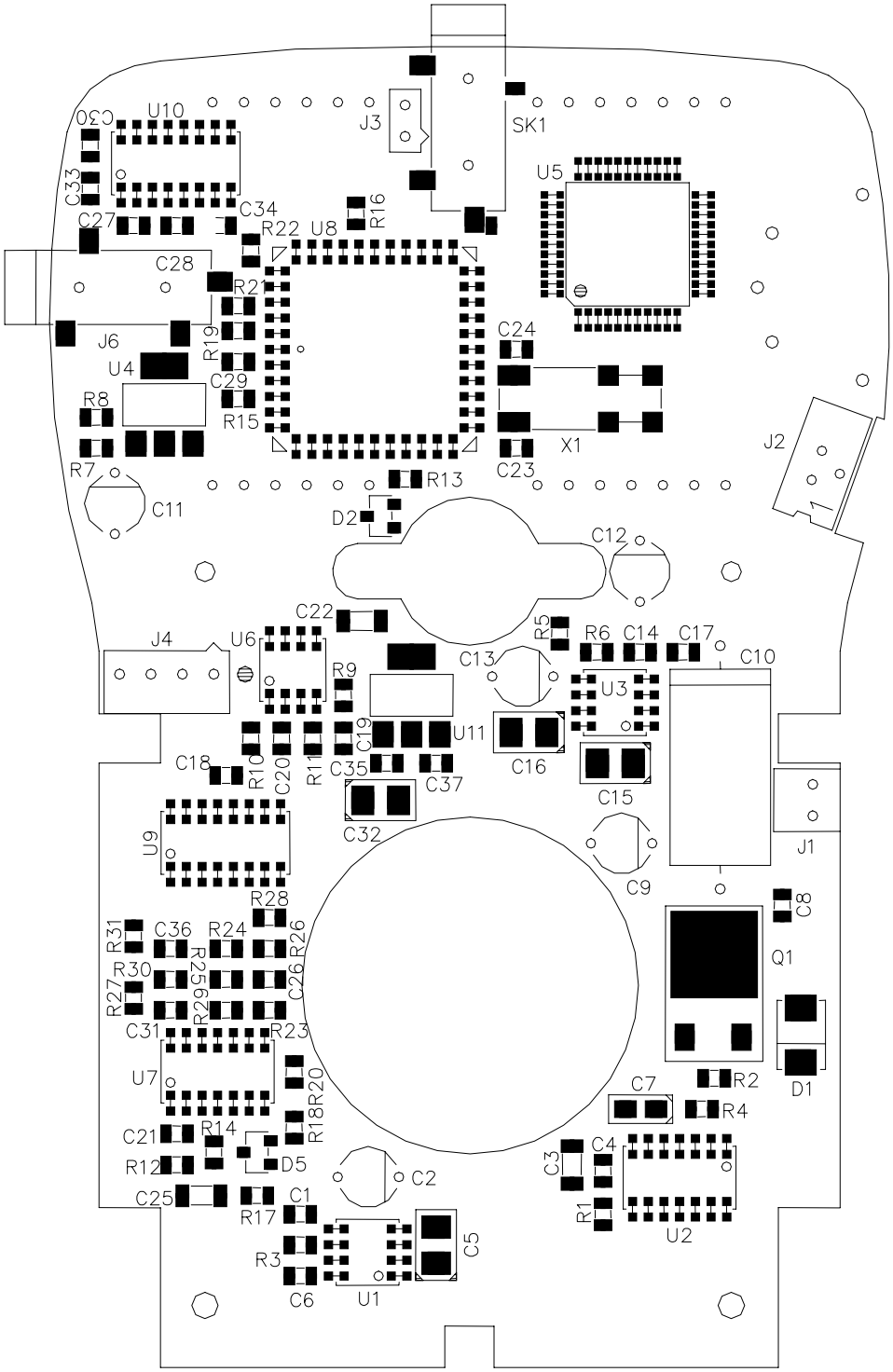
The following section contains the following circuit diagrams and Engineering Drawings: -

- PD1 Audio PCB Layout
- PD1+ Audio PCB Layout
- PD1 2MHz Probe assembly
- PD1 Audio PCB assembly
- 2MHz Transducer PCB assembly
- PD1+ Audio PCB assembly
- PD1 GA
- PD1+ GA
- 2MHz Transducer GA

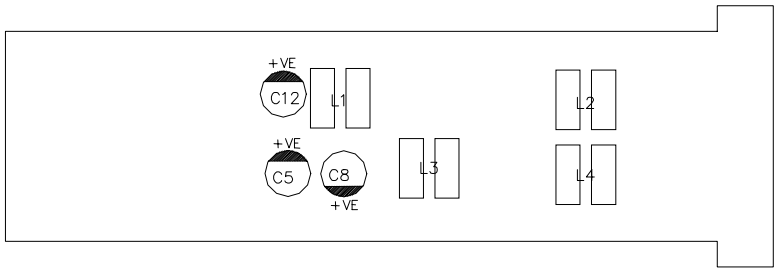
PD1 Audio PCB Layout



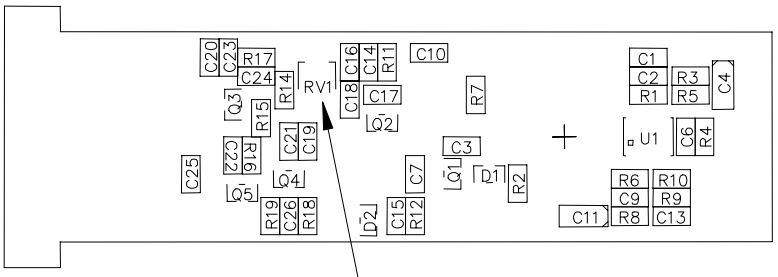
PD1+ Audio PCB Layout



PD1 Probe PCB Layout



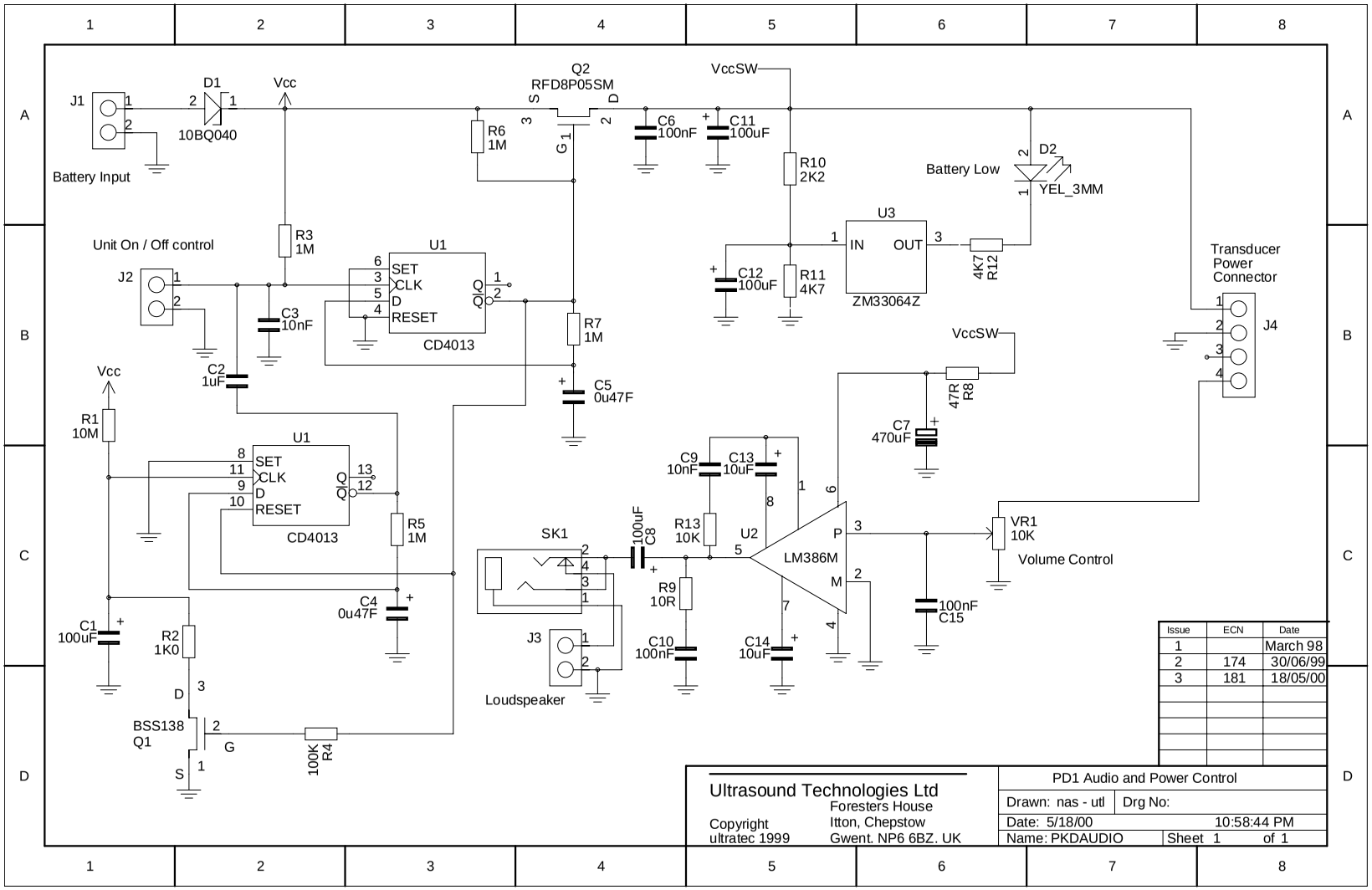
Top side



Under side

RV1 Modifications

Fit 100R resistor to position RV1 using pads shown



Issue	ECN	Date
1		March 98
2	174	30/06/99
3	181	18/05/00

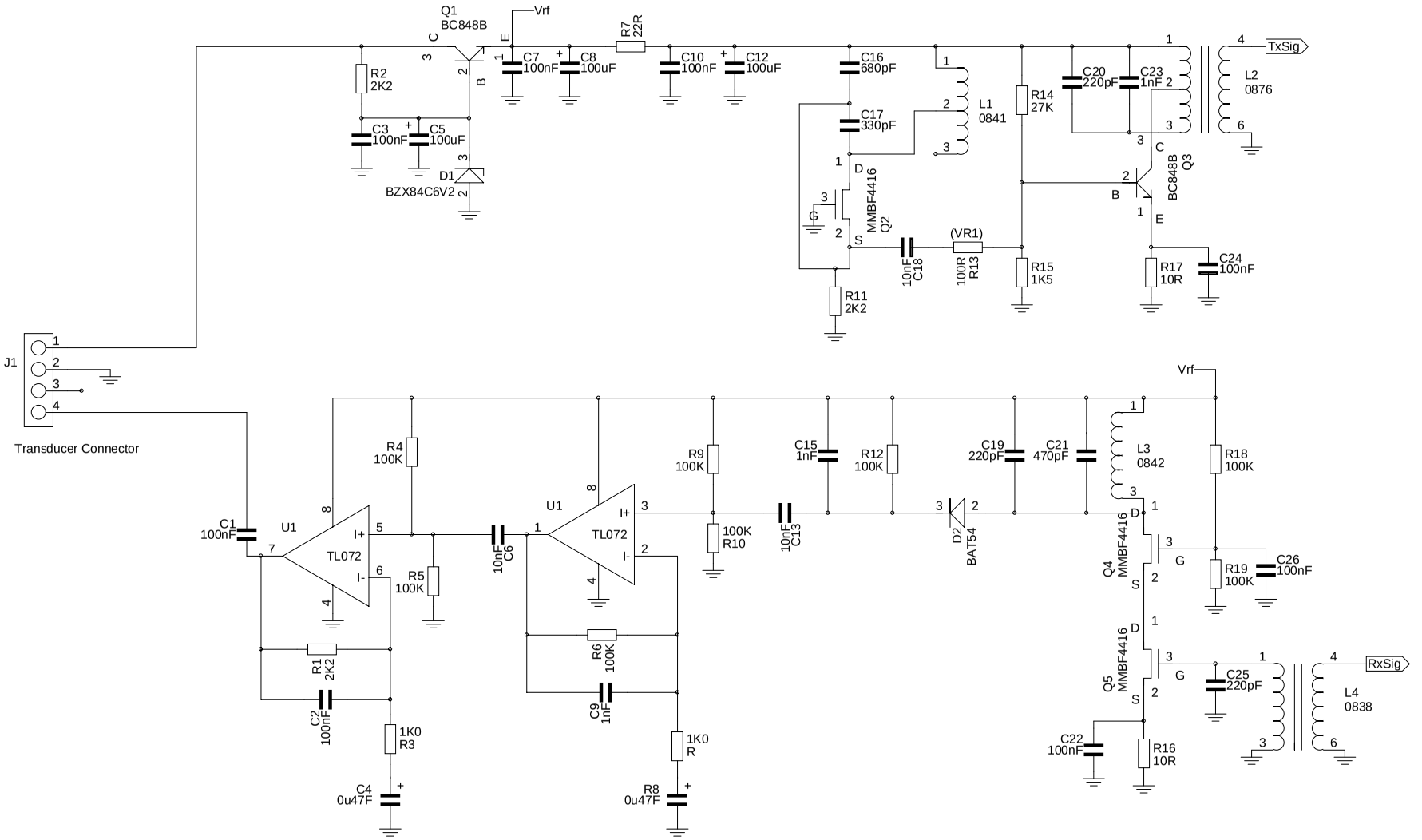
Ultrasound Technologies Ltd
Foresters House
Itton, Chepstow
Gwent. NP6 6BZ. UK

PD1 Audio and Power Control

Drawn: nas - utl | Drg No:

Date: 5/18/00 10:58:44 PM

Name: PKDAUDIO | Sheet 1 of 1



Issue	ECN	Date
1		March 98
2		15/05/98
3	158	18/01/99
4	181	18/05/00

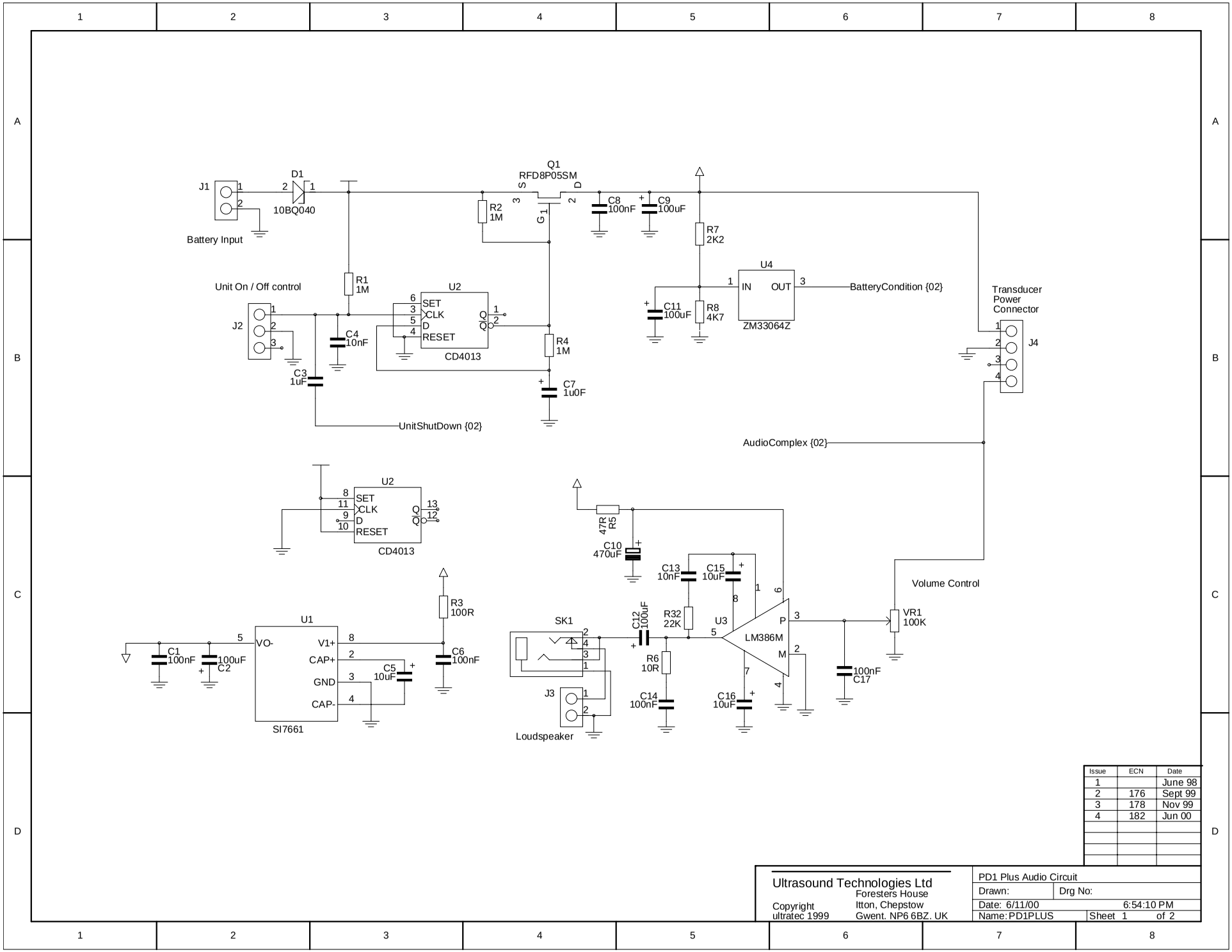
Ultrasound Technologies Ltd
Foresters House
Itton, Chepstow
Gwent. NP6 6BZ. UK

Pocket Doppler Fetal Transducer 2MHz

Drawn: nas - utl | Drg No:

Date: 6/11/00 1:58:30 PM

Name: FETALTDR | Sheet 1 of 1



Issue	ECN	Date
1		June 98
2	176	Sept 99
3	178	Nov 99
4	182	Jun 00

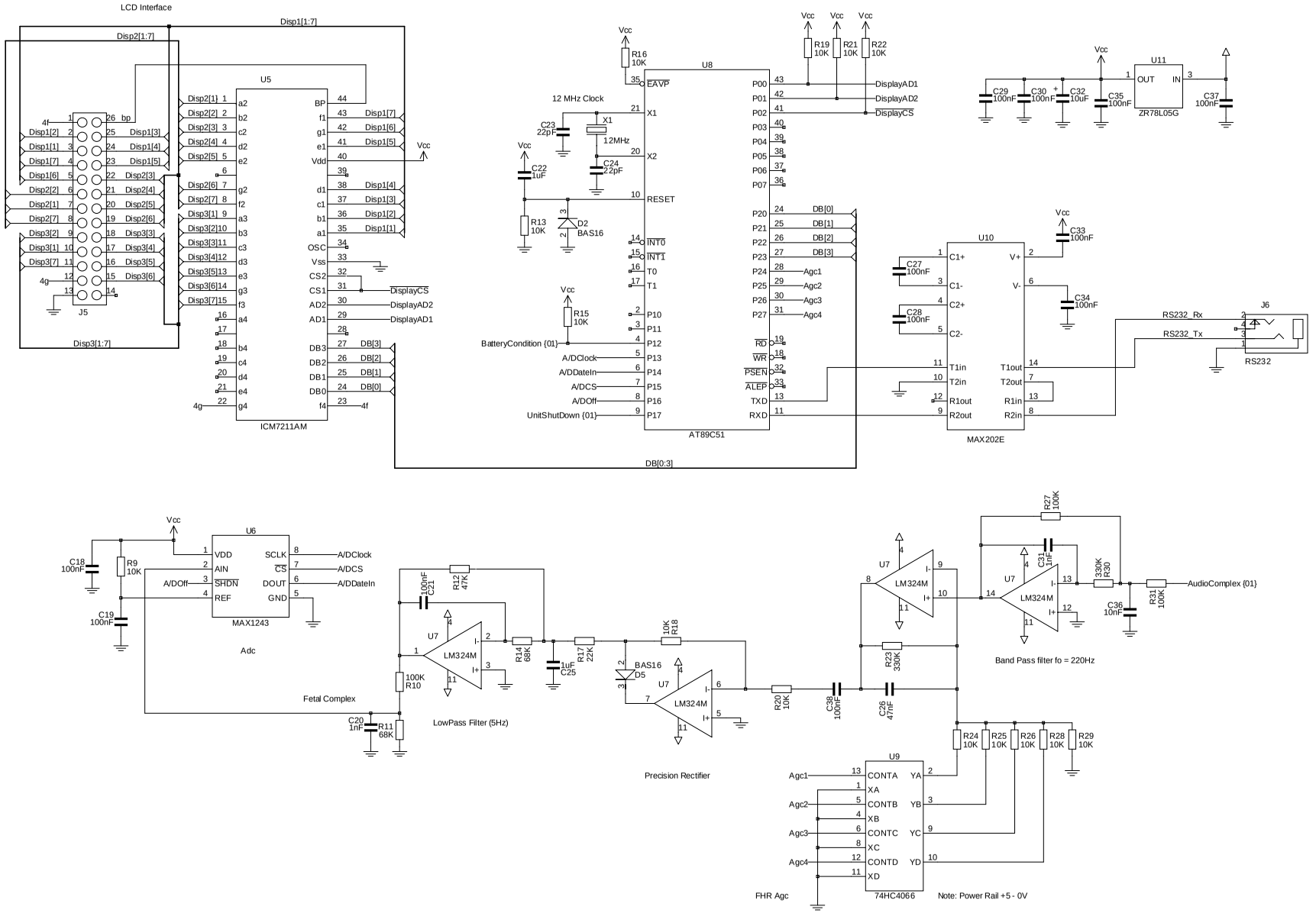
Ultrasound Technologies Ltd
Foresters House
Itton, Chepstow
Gwent. NP6 6BZ. UK

PD1 Plus Audio Circuit

Drawn: | Drg No:

Date: 6/11/00 6:54:10 PM

Name: PD1PLUS | Sheet 1 of 2



Issue	ECN	Date
1		June 98
2	176	Sept 99
3	178	Nov 99
4	182	June 00

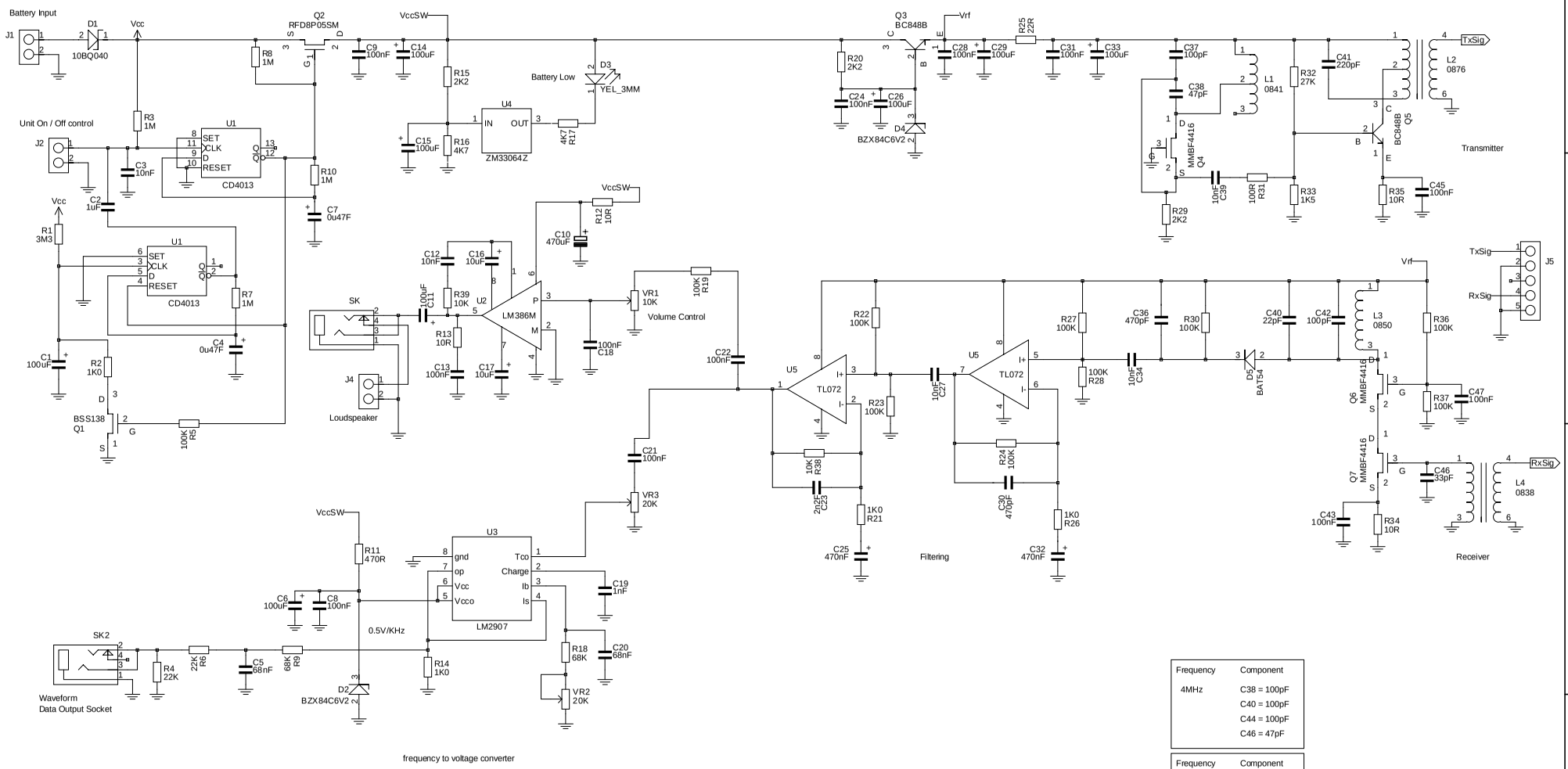
Ultrasound Technologies Ltd
Foresters House
Itton, Chepstow
Gwent. NP6 6BZ, UK

PD1 Plus Digital Signal Processor

Drawn: | Drg No:

Date: 6/11/00 6:54:10 PM

Name: PD1PLUS | Sheet 2 of 2



Frequency	Component
4MHz	C38 = 100pF
	C40 = 100pF
	C44 = 100pF
	C46 = 47pF

Frequency	Component
8MHz	C37,38 = 22pF
	C40,41 = 47pF
	C42 = 220pF
	C44,46 = 22pF
	L3 = 0874
	L4 = 0839

Issue	ECN	Date
1		Nov 99

Ultrasound Technologies Ltd
Foresters House
Itton, Chepstow
Gwent. NP6 6BZ, UK

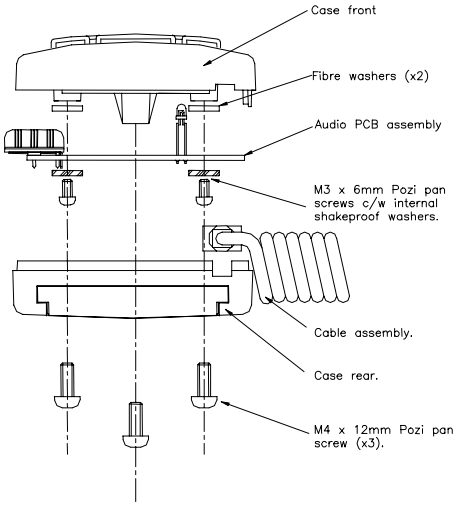
PD1 Vascular (5MHz)

Drawn: NAS | Drg No:

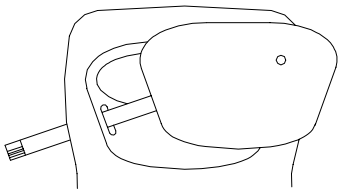
Date: 10/19/00 3:24:04 PM

Name: PD1VAS~1 | Sheet 1 of 1

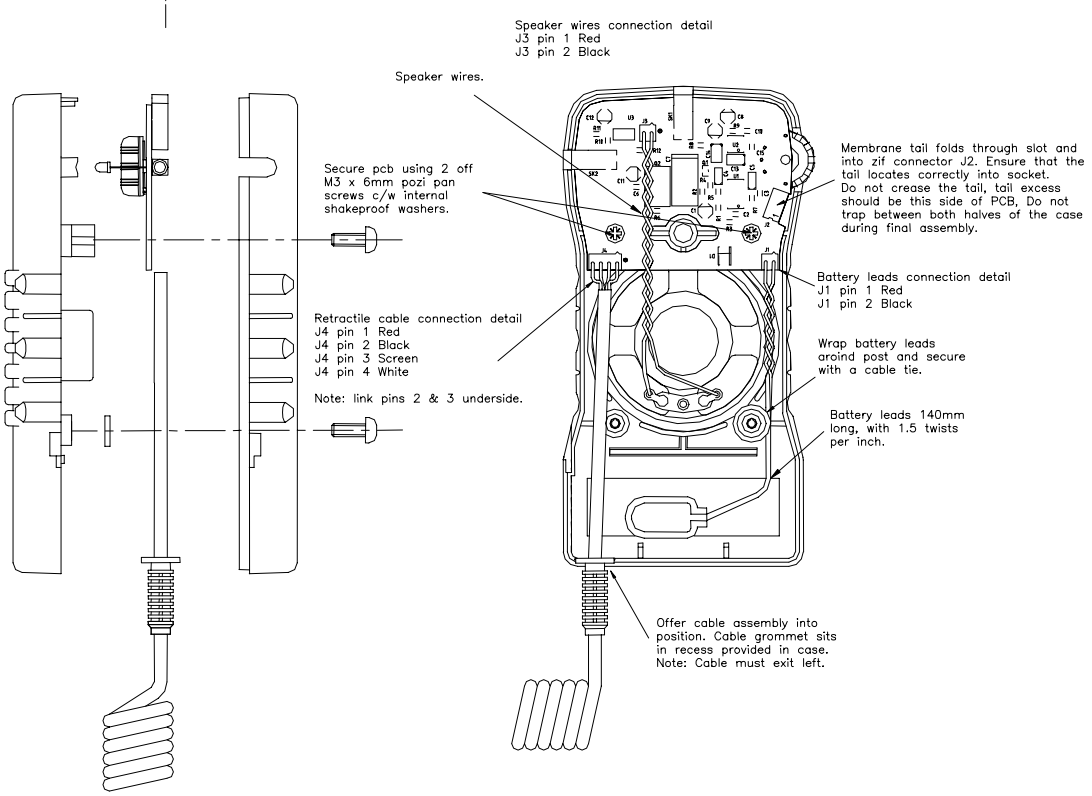
PD1 General Assembly



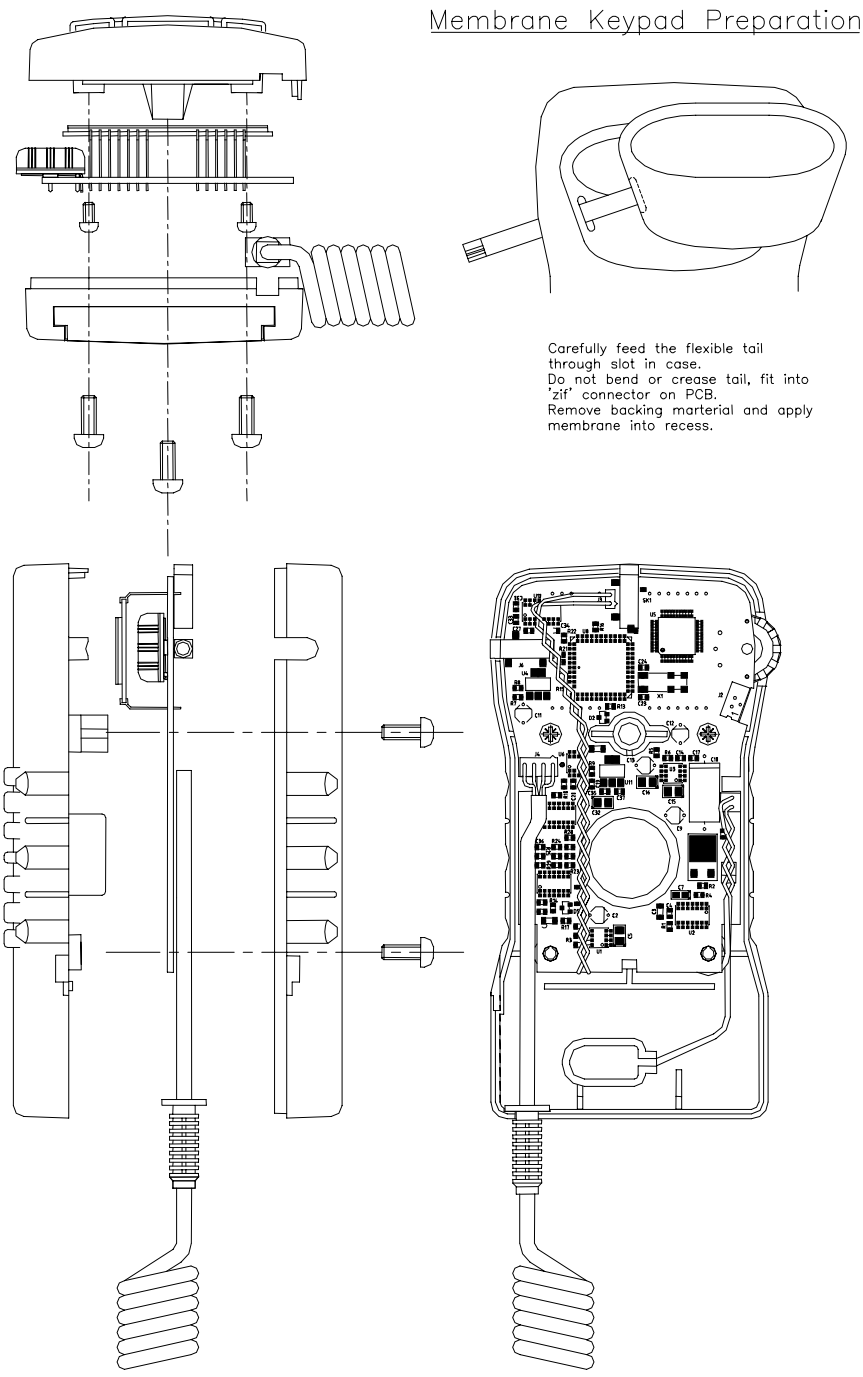
Membrane Keypad Preparation



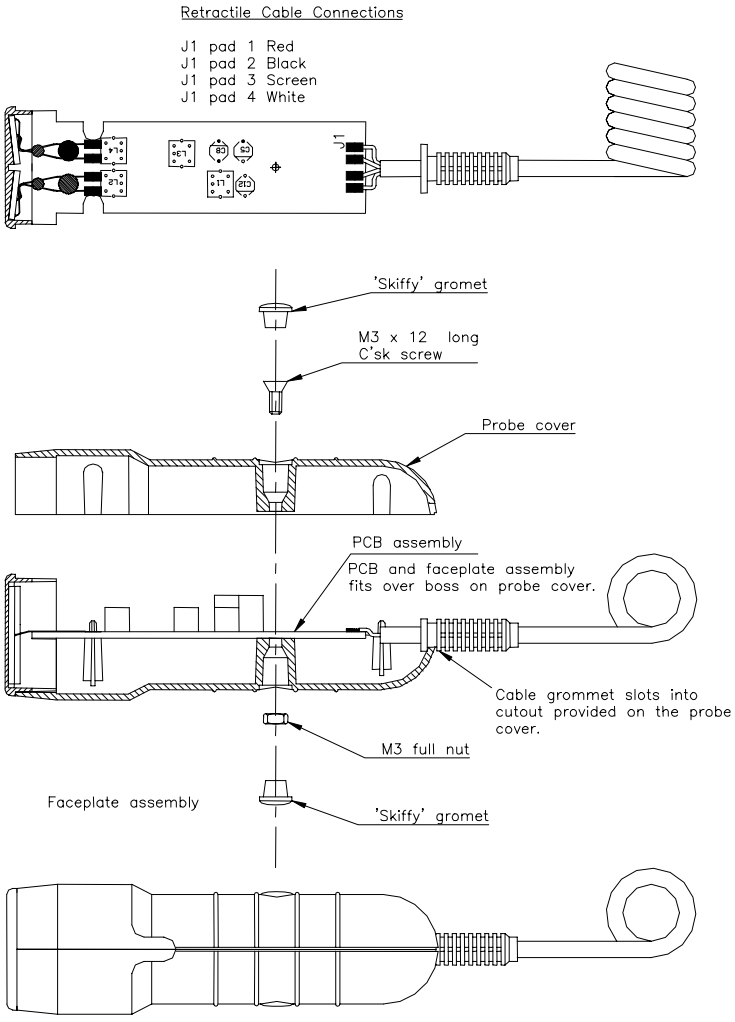
Carefully feed the flexible tail through slot in case.
Do not bend or crease tail, fit into 'zif' connector on PCB.
Remove backing marterial and apply membrane into recess.



PD1+ GA


Membrane Keypad Preparation
Carefully feed the flexible tail through slot in case.
Do not bend or crease tail, fit into 'zif' connector on PCB.
Remove backing marterial and apply membrane into recess.

2MHz Transducer Assembly



TRANSDUCER ASSEMBLY (complete)